AP Chemistry: Other Aspects of Aqueous Equilibria

AP Chemistry Other Equilibria WS 0809.doc

Name: _____ Date: _____ Per: _____

1. Write the solubility product expressions for the following salts:
   a) AgCl b) Hg_2Cl_2 c) $Pb_3(AsO_4)_2$

2. A liter of solution saturated at 25.0°C with calcium oxalate, CaC_2O_4, is evaporated to dryness, giving a 0.0061g residue of CaC_2O_4. Calculate the solubility product constant for this salt at 25.0°C.

3. By experiment, it is found that $1.2x10^{-3}$mol of lead(II)iodide, PbI_2, dissolves in 1.00L of aqueous solution at 25.0°C. What is the solubility product constant at this temperature?

4. Anhydrite is a calcium sulfate mineral deposited when seawater evaporates. What is the solubility of calcium sulfate, in grams per liter if K_{sp} for calcium sulfate is $2.4x10^{-5}$?

5. Determine the molar solubility of calcium oxalate in 0.15M calcium chloride? Use the solubility constant determined in question 2 above, and compare the relative solubility of the CaC_2O_4 under both conditions.

6. Sulfate ion, SO_4^{2-}, in solution is often determined quantitatively by precipitating it as barium sulfate, $BaSO_4$. The sulfate ion may have been formed from a sulfur compound. Analysis for the amount of sulfate ion then indicates the percentage of sulfur in the compound. Is a precipitate expected to form at equilibrium when 50.0mL of 0.0010M $BaCl_2$ is added to 50.0mL of 0.00010M Na_2SO_4? The solubility product constant for barium sulfate is $1.1x10^{-10}$. Assume that the total volume of solution, after mixing, equals the sum of the volumes of the separate solutions.

7. Consider two slightly soluble salts, calcium carbonate and calcium sulfate. Which of these would have its solubility affected more by the addition of the strong acid HCl? Would the solubility of the salt increase or decrease?

8. Ascorbic acid (vitamin C) is a diprotic acid, $H_2C_6H_6O_6$. What is the pH of a 0.10M solution? What is the concentration of the ascorbate ion, $C_6H_6O_6^{2-}$? The acid ionization constants are $K_{a1} = 7.9 \times 10^{-5}$ and $K_{a2} = 1.6 \times 10^{-12}$.

9. Morphine, $C_{17}H_{19}NO_3$, is administered medically to relieve pain. It is a naturally occurring base, or alkaloid. What is the pH of a 0.0075M solution of morphine at 25.0°C? The base ionization constant $K_b = 1.6 \times 10^{-6}$ at 25.0°C.

10. What is the pH of 0.10M sodium nicotinate, $NaC_6H_4NO_2$, at 25.0°C? The K_a for nicotinic acid (niacin) is 1.4×10^{-5} at 25.0°C.

11. Instructions for making up a buffer say to mix 60.0mL of 0.100M NH_3 with 40.0mL of 0.100M NH_4Cl. What is the pH of this buffer? (K_b for $NH_3 = 1.8 \times 10^{-5}$)

12. Calculate the pH of 75mL of the buffer solution described in question 11 above if 9.50mL of 0.100M hydrochloric acid is added to the solution.

13. Calculate the pH during a titration in which 10.0mL of 0.100M NaOH has been added to 25.0mL of 0.100M HCl.

14. Will silver chloride precipitate from a solution that is a) 0.010M $AgNO_3$ and 0.010M NaCl? b) if it is also 1.00M NH_3?